

whilst 65 are winter visitors and 75 occasional visitors. The range of each is carefully traced through the county, and the time of arrival, nidification, number of broods, number of eggs, comparative abundance, together with numerous notes of local interest and peculiarities of habit, are given.

In short, Mr. Mitchell has performed his task well, and has obviously been at much pains to render his information as complete and reliable as possible. The work will be welcome and useful to all who take an interest in British birds, and must prove indispensable to the many north-country artisan-naturalists whose leisure time from toil in noisy mill or factory is spent in studying natural history in the suburbs of their crowded towns. We hope that provincial naturalists will not rest until every county not yet favoured with a handbook to its bird-life can boast of one planned with as much care and carried out with as much completeness as the useful and interesting little volume before us. C. D.

*Memoirs of the Geological Survey of India. Palæontologia Indica, being Figures and Descriptions of the Organic Remains procured during the Progress of the Geological Survey of India.* Published by order of His Excellency the Governor-General of India in Council. Series x. *Indian Tertiary and Post-Tertiary Vertebrata*.—Vol. III. Part 1. *Additional Siwalik Perissodactyla and Proboscidea*, with 5 plates and 6 woodcuts. Part 2. *Siwalik and Narbada Bunodont Suina*, with 7 plates and 1 woodcut. Part 3. *Rodents and new Ruminants from the Siwaliks, and Synopsis of Mammalia*, with 1 plate and 8 woodcuts. Part 4. *Siwalik Birds*, with 2 plates. Part 5. *Mastodon Teeth from Perim Island*, with 2 plates. By R. LYDEKKER, B.A., F.G.S., F.Z.S. 4to. Calcutta: Geological Survey Office. London: Trübner & Co. 1884.

THE Memoirs included in Mr. Lydekker's third volume of Indian Tertiary Vertebrata are varied in matter and vary in importance. We may say of the volume as a whole, that it makes an important, valuable, and welcome contribution to the knowledge of the subjects of which it treats; and every anatomist will need to examine in detail the materials described and discussed in the successively issued parts of the work.

Part 1 opens with an account of *Aceratherium Blanfordi*, founded on materials collected by Mr. W. T. Blanford in the Lower Siwaliks of the extreme west of India.

Upper molar teeth of two races of this rhinoceros are described, which differ in size. Its affinities are with the *Rhinoceros palæindicus*, which, however, has the external surface of the molar teeth flatter. The bases of the two colles are in contact in *R. palæindicus*, and that species wants the tubercle at the entrance to the median valley. The distinction of *A. Blanfordi* from *Rhinoceros sivalensis*

is found in that species having the second costa of the molar teeth more prominent, in the anterior collis having no vertical groove on its posterior side, in the ante-crochet of *A. Blanfordi* being absent, while the crochet is relatively larger. The molar teeth of *Aceratherium perimense* are distinguished from those of *A. Blanfordi* by greater development of the buttress and costa, while the ante-crochet is less developed, and the posterior valley forms a deep pit instead of a slit. Figures are given of the mandible, showing its general form, and indicating that the symphysis approximated to the characters of the Javan rhinoceros.

The lower molars have a faint trace of an external cingulum. After comparing this Indian fossil with other species of rhinoceros, the author concludes that there is a strong presumption that it is an *Aceratherium*, though it is difficult at present to establish distinction from its American allies. The two races are distinguished as *majus* and *minus*. Among European types it finds its nearest ally in *A. incisivum*; and the *Rhinoceros deccanensis* is thought to have been a descendant from the same stock as *Aceratherium Blanfordi*.

*Hipparion antilopinum* has a cranium referred to it from the Siwaliks of Perim Island, in which the teeth exhibit the complete isolation of the anterior pillar characteristic of *Hipparion*, though the pillar is less elongated than in the teeth referred to *H. Theobaldi*. Still, the skull is only determined provisionally, and is compared with *H. gracile*, with the conclusion that the form of the posterior maxillary cavity establishes a specific distinction. Other teeth from Perim Island are described, and if they prove to belong to a new species it may be named *H. Feddeni*.

The remainder of the memoir is devoted to Mastodons. Three tetalophodont species and two trilophodont species have been already described from the Siwaliks, and the author now indicates trilophodont types. Concerning the genealogy of the Elephants, it is observed that the presence of simple tetraconodont premolars in some Mastodons suggests their descent from some ungulate with teeth of this type, in which premolars were as fully developed as molars; and that it is merely necessary to assume the addition of an extra pair of columns in each of the true molars of the Bunodont Artiodactyla to produce a dentition analogous to that of the simple-toothed Mastodons. A variety of *Mastodon angustidens* named *M. palaeindicus* is described from teeth. It has a tendency to a rather more complex structure of the molars than is usual in the European type, and there is a greater curvature of the borders of the crown in the third molar of the lower jaw, both these characters approximating towards *M. pandionis*, with which it is associated in the extreme western border of India. Further descriptions are given of teeth of *Mastodon pandionis*, which is also closely allied to *Mastodon angustidens*, though the structure of the molars is more complex and the cement of the teeth is developed. It appears to have survived to a later epoch than *M. angustidens*, being found in the Upper Siwaliks.

The third type of this group is the new species *Trilophodon Falconeri*. The tooth differs from those of *M. pandionis* in its smooth enamel, low vertical ridges, wide transverse valley, and trefoil-shaped dentine islets.

Part 2 opens with a statement of the author's conviction that the Indian species of *Dinotherium* must be maintained, and are not to be identified with the European type.

Dr. Falconer's divisions of the genus *Hippopotamus*, named *Hexaprotodon* and *Tetraprotodon*, are here united, and Leidy's genus *Chæropsis* is included with them in the genus *Hippopotamus*. Some account is given of crania of *Hippopotamus sivalensis*, in which the molar teeth vary in proportions; and the author finds that a large series of vertebræ and limb-bones show distinctions from *Hippopotamus amphibius*. The spinous process of the axis is higher, the odontoid process blunter; the scapula has its long diameter shorter; the femur apparently includes two types; the astragalus is longer than in *H. amphibius* and approximates to the pigs.

A small hippopotamus from Burma, named by Falconer and Cautley *Hexaprotodon iravaticus*, is distinguished from *H. sivalensis* by the shorter symphysis and the greatly diminished interval between the canines, in which characters it makes a nearer approach to the pigs than any other hippopotamus. The species *H. namadicus* was referred to by Falconer as larger than *H. amphibius* or *H. sivalensis*. It has only been obtained from the Narbadas, and the author observes that the crania referred by Falconer to *H. palæindicus* might with equal reason be referred to *H. namadicus*, and describes a mandible. *H. palæindicus* presents a singular type of mandible, the jaw being that of a *Hexaprotodon* in process of conversion into a *Tetraprotodon*, the middle incisors being forced inwards and greatly reduced in size by the development of the first and third incisors. The *H. iravaticus* is the most generalized Indian species, and steps of successive modification are exhibited by the species *H. sivalensis*, *H. namadicus*, and *H. palæindicus*, at least as shown in the increased shortening of the symphysis of the mandible. *H. amphibius* in length of symphysis rather exceeds the Narbada hippopotamus, its inner incisors are large and the outer incisors small; but in *H. liberiensis* the small outer incisor has disappeared.

The representatives of swine among the Siwalik rocks are referred to the genera *Sus*, *Hippohyus*, *Sanitherium*, and *Hyootherium*. An interesting summary of modifications of the genus *Sus* precedes the description of Indian species. *Sus giganteus* of Falconer and Cautley is described from specimens of crania, dentition, and mandible, so as to show its differences from *S. scrofa*, *S. cristatus*, *S. barbatus*. The third and fourth premolars of this species are wider and stouter than the corresponding teeth of most existing pigs; but the structure is similar to that of the premolars of *Tetraconodon*. *Sus titan* is a new species founded on mandible, cranium, teeth, and limb-bones, and is regarded as distinct from *S. giganteus*. The first and second molars are of narrower and more elongated type than in that species; but whether it is distinct from the European types may admit of

some doubt, and it is stated that *S. titan* in the structure of its lower premolars is intermediate between the mandible referred to *S. giganteus* and the fossil European pigs. Another species is named *Sus Falconeri*, and although the name is new it is adapted to some well-known materials. Its cranium approximates to that of the living *S. barbatus* of Borneo, though the living species has the palate more produced behind the third molar tooth; and this fossil is well distinguished from most of the other fossil species by the structure of its molars, which are of complex character. In this structure it makes an approximation to *Phacochoerus*, especially in its last lower molars, which might be converted into those of *Phacochoerus* if the main columns were isolated and reduced to the size of the accessory columns. In another direction the teeth of this species approximate to the still more complex molars of *Hippohyus*. *Sus hysudricus* is a fourth species, figured by Falconer, known from ample materials, which indicate that it is distinct from living pigs in having larger and stouter premolars, which somewhat approximate to those of the African river-hogs, and in having the molars of the male wider with lower crowns. The last upper molars have a conspicuously developed cingulum. A fifth species is *Sus punjabensis*, known from a mandible. It was a diminutive pig, no larger than the existing pigmy hog of Nepaul, of which it is supposed to be the ancestor. It was about as large as a hare.

*Hippohyus sivalensis* is described from the cranium and mandible, which make some approximation to *Hyotherium*, though the structure of the molars is much simpler. The true molars somewhat resemble those of *Hippopotamus*, but have the longitudinal and transverse valleys equally developed. The molars may also be compared with those of *Hemimeryx* or *Hyopotamus*.

*Sanitherium Schlagintweiti* of Von Meyer is identified with the *Sus pusillus* of Falconer. This genus has a well-marked cingulum which distinguishes it from *Hippohyus*, and in several respects it makes an approximation to *Sus*.

*Hyotherium* is another genus of Von Meyer's hitherto somewhat loosely identified, which the author recognizes in India. The species *H. scindiensis* is known from a few molar teeth. In *Hyotherium* European specimens show that the canines and lower incisors are but little specialized.

*Tetraconodon magnus* is a Siwalik type only known from molars and mandible.

*Listriodon*, which occurs in the Middle Miocene of Europe, is represented by two species in the Siwaliks. It was referred to the genus *Tapirus* by Falconer, and classed with the Bunodont Suina by Lartet. The species *L. pentapotamiae* is closely allied to the European form; but the second species, *L. Theobaldi*, is smaller and distinguished by having the transverse valley wider and more open, and by wanting oblique ridges running from the anterior and posterior cingula to the summits of the main ridges. The memoir concludes with a list of writings upon the fossils described.

In the third part are descriptions of a few rodents from the



Siwalik beds. *Rhizomys sivalensis* is known from mandibles and a calcaneum, and appears to be distinguished from living species by the relative size and breadth of the molar teeth. The porcupines are represented by a mandible named *Hystrix sivalensis*. Comparisons are made to distinguish it from *H. cristata* and *H. hirsutirostris*, as well as to show its relations with other fossil species. A young cranium is also figured which probably belongs to the same species. Then follow supplementary notes on ruminants. First the *Cervus latidens* of a previous volume is redescribed as *Oreas? latidens*, with the conclusion that the dentition indicates a large antelope nearly equal to the eland, having marked affinity with *Oreas* and less conspicuous affinity with *Tragoceros* and *Palaoryx*. An upper molar is similarly referred with doubt to the genus *Palaoryx*. Other remains are considered to indicate the genus *Boselaphus*. *Tragulus sivalensis* is a Siwalik type known from its teeth, and the author finds no difference but size to separate the fossil from existing species, though such slight variation as exists makes some approach to *Moschus*. *Moschus* is a genus indicated with doubt on the evidence of a premolar, and it is remarked that it is impossible to distinguish this tooth from that of the musk-deer except by its smaller size.

The genus *Cervus*, enlarged to include the various subgenera, yields two new species. *Cervus simplicidens* closely approaches in tooth-characters to *Cervus axis*, having the necks of the crowns of the true molars on different levels; but in the living species the third upper premolar is relatively shorter, the outer part of the fourth premolar rather less symmetrical, and the true molars relatively wider. *Cervus triplidens* is nearly allied to the *C. Davidianus*. They have strongly marked costae on their outer surfaces, and the crowns are higher than those of *Cervus simplicidens*. A third species, *Cervus sivalensis*, is represented by teeth resembling those of *C. Duvaucelli*, but having more rugose enamel, a distinct cingulum, and a smaller accessory column in the molar teeth.

Then succeeds a useful synopsis of the Siwalik and Narbada Mammalia, with references to the original descriptions and to the previous parts of the present work. Advantage is taken of this recapitulation to vary the nomenclature of some of the types.

Part 4 is devoted to the Siwalik birds, some of which have already been described by Mr. William Davies. Among these is the *Pelecanus Cautleyi*, founded on the distal extremity of a left ulna. Although the comparisons have shown it to be distinct from such species as were available for comparison, the author regards the name as provisional, since existing species remain with which no comparison can be made.

A second species is the *Pelecanus sivalensis*, also founded on the distal extremity of an ulna, and for similar reasons the name is regarded as provisional. *Phalacrocorax* is known from a metatarsus, and is almost undistinguishable from *P. carbo* of New Zealand. *Leptoptilus Falconeri* is founded on various remains, which also appear to the author to make the name provisional. An indeter-

minate cervical vertebra is regarded as indicating a Siwalik stork or allied form. The genus *Mergus* is quoted with doubt on the evidence of a cervical vertebra. *Struthio asiaticus* was an ostrich closely allied to the existing species, and the author doubts whether the slight differences in their cervical vertebræ can be of more than individual or varietal value; so that this species is regarded as provisional.

The *Dromæus sivalensis* has since been withdrawn by the author on the ground that the bones must be referred to an Artiodactylate mammal.

Part 5 is devoted to Mastodon teeth from Perim Island. They comprise the first and last upper true molars of *Mastodon pandionis*, and the second right upper true molar, upper milk-molars, and penultimate lower molar of *Mastodon perimensis*; and having described these teeth in detail, the author regards it as evident that the tetralophodont *M. perimensis* is a more specialized form than the trilophodont *M. pandionis*. In order to convert the teeth of the latter into the former type it is necessary that the anterior accessory columns should be less developed, so that the valleys would be more open. A fourth ridge should be developed in the intermediate molars, and a fifth ridge and double talon in the last molar. Both species have cement in the valleys. It is considered as likely that *Mastodon sivalensis* is a descendant from the stock of *Mastodon pandionis*, and it is thought probable that *Mastodon pandionis* and *Mastodon pentelici* are both branches from the older stock of *Mastodon angustidens*.

In this volume a considerable mass of material is made known and illustrated by figures, which for the most part are excellent; and it is a great gain to palæontology for naturalists to be in possession of the author's descriptions. Admirable in many ways, the work suffers from the disjointed manner in which the growth of material has caused the parts to be issued; and some of the descriptions rather convey the impression of unnecessary haste in publishing what might perhaps have been perfected by fuller consideration. There is an appearance of desiring to leave nothing for those who may come hereafter, and yet at the same time to leave open a way for retiring from positions which future research may make untenable. Many of the species instituted by the author seem to us to be founded on characters which would justify us in extending to them the term provisional, which so often characterizes species founded by others. Space might sometimes have been gained which could with advantage have been taken for more extended description. Not but what the descriptions are excellent in their way, only they could in many cases have been fuller with advantage. The author's strong interest is rather with what may be termed genetic comparisons. He has done much to unravel the affinities of species by comparing them with existing and fossil allies; and the speculations on descent of species are usually justified by the nature of the materials and the interest of the problems involved. But suggestive as this pursuit of evolution undoubtedly

is, its value is always in proportion to the degree to which evidence has been previously elaborated by laborious descriptions and comparative figures. The author's mental attitude rather disposes him to write for those who have already written on similar subjects, than for the many who might become students. But even in this he has impressed his own individuality on his work in his own way, and we take that work with much gratitude for the labour, ability, and research which it manifests.

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THE Labyrinthodont which gives a title to this memoir is a new generic type named by the author *Gondwanosaurus bijoriensis*. The name is taken from the geological series, Gondwana system, in which it occurs, and the Bijori group, an upper subdivision of the same series in the Satpura district. The preservation is not all that could be desired, the bones having disappeared from the exposed portions of the specimen. The skull is about the size of that of the well-known *Loxomma Allmanni*, and is shown to be labyrinthodont by the structure of the teeth, a parietal foramen, the presence of epiotic cornua, and the structure of the thoracic shield. Only in the region of the epiotic bones is there a trace of external surface, and there the ornament is closely pitted. The exoccipital region appears to show no trace of the characteristic amphibian exoccipital condyles, a character not without importance in determining the classificatory position of this animal and its allies. The author relies mainly upon the figures to convey a conception of the form, proportions, and structure of the skull, and the relations of its several elements. The outline was triangular, with a rounded muzzle, the length to the breadth being as two to three. The orbits are oval, separated by the diameter of an orbit, and are in the posterior half of the cranium. The parietal foramen is just behind the eyes. An oval plate, which has the aspect of a perforation in the cranial bone, occurs on each side of the foramen. The author regards this as a bony pedicle ; but having only the figure to judge from, it appears to us to be an indication of minute temporal fossa, and if so is not entirely without interest as bearing upon the affinities of the group. In the pre-orbital region there is on one side a slight depression, thought to indicate a small lyra. The nares appear to have been near the extremity of the snout. On the palatal aspect there is a similar absence of bony elements ; but a